EAD THIS IMPORTANT INFORMATION

RAYTHEON

RAY-TEL

Citizens Band

RADIOTELEPHONE

Installation and Operation

RAYTHEON COMPANY
Distributor Products Division
411 Providence Turnpike Westwood, Mass.

LITHO IN U. S. A.

WARRANTY

Raytheon warrants all parts of this equipment to be free from all defects in workmanship and/or material for ninety (90) days after purchase by the consumer or user, provided:

a Warranty Registration Card has been filed within thirty days from date of purchase;

b Raytheon is promptly notified in writing upon discovery of such defects;

c Raytheon's examination shall disclose to its satisfaction that such defects have not been caused by abuse or tampering.

Notes

a Should trouble occur, see the dealer from whom your equipment was purchased. Normally it should require only a simple adjustment. Your dealer has complete technical service information, or the factory will be glad to assist you directly with any problem.

b Raytheon will not be liable for special or consequential damages of any nature with respect to merchandise sold, delivered, or ordered.

c Raytheon reserves the right to make changes or improvements to its products from time to time without incurring obligation to install same on equipment previously sold.

Raytheon Company makes no warranties, whether of merchantability or otherwise, except as set forth above. Raytheon Company neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with this equipment.

RAYTHEON COMPANY

RAY-TEL
CITIZENS RADIOTELEPHONE
INSTRUCTION BOOK

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Dimensional Drawings
Circuit Diagram

Channel Number	Channel Frequency Kc.	Transmitter Crystal Kc.	Receiver Crystal Kc.
1	26,965	13,482.5	26,510
2	26,975	13,487.5	26,520
3	26,985	13,492.5	26,530
4	27,005	13,502.5	26,550
5	27,015	13,507.5	26,560
6	27,025	13,512.5	26,570
7	27,035	13,517.5	26,580
8	27,055	13,527.5	26,600
9	27,065	13,532.5	26,610
10	27,075	13,537.5	26,620
11	27,085	13,542.5	26,630
12	27,105	13,552.5	26,650
13	27,115	13,557.5	26,660
14	27,125	13,562.5	26,670
15	27,135	13,567.5	26,680
16	27,155	13,577.5	26,700
17	27,165	13,582.5	26,710
18	27,175	13,587.5	26,720
19	27,185	13,592.5	26,730
20	27,205	13,602.5	26,750
21	27,215	13,607.5	26,760
22	27,225	13,612.5	26,770
23	27,255	13,627.5	26,800

Receiver crystals are ground for 20 mmfd load capacity; transmitter crystals are ground for 20 mmfd load capacity also.

III. OPERATING PROCEDURE

A. Receiver. The receiver ON/OFF switch and Volume Control is located on the lower left corner of the front panel. Advance the knob clockwise to turn the set on. Allow 30 seconds for the tubes to reach operating temperature with the channel switch set to a position in which crystals are installed. A background hiss, controllable in intensity by the Volume Control, will be heard, assuming the ANL-Squelch control is in the OFF position.

The lower right knob on the front panel controls the automatic noise limiter (ANL) and the Squelch. When ignition or other noise interference is present, the knob should be advanced beyond the click at the counter-clockwise end of rotation. This activates the ANL function which greatly attenuates noise without materially affecting the readability of desired signals.

The Squelch Control silences the receiver during periods when no transmissions are being received. Thus, the annoying background noise usually heard when standing by is eliminated. To operate this control, adjust the volume control to a comfortable level and, with no signal being received, turn the Squelch control clockwise until the background noise just disappears. Do not turn the control beyond this point, since this would impair the set's ability to receive weak signals.

B. Transmitter. To operate the transmitter, first place the TALK-REC.-REC ONLY switch in the upward position. Allow 30 seconds for the transmitter tube to warm up, and then press the microphone button. The TALK INDICATOR lamp will glow and its brightness will increase as you speak into the microphone.

The unit is now ready for operation and contact may be established with other units operating on the same channel. Note: To save battery drain on battery operated units, the TALK-REC. switch should be left in the REC. ONLY position during listening periods when the transmitter is not in frequent use.

IV. INSTALLATION

A. Equipment Furnished. Unpack the carton containing your radiotelephone and check the contents carefully. It should contain the following:

1. Raytheon RAY-TEL radiotelephone
2. Instruction Manual
3. Two crystals (one transmit, one receive) installed in Channel Position A
4. Battery and 115 volt a-c connecting cords
5. Spare Fuses
6. Microphone and Mounting Post
7. Mounting Yoke Assembly

If any items are missing or broken, contact your dealer immediately.

The following accessories are available at extra cost:

1. Front cowl type whip antenna
2. Rear fender or deck mount whip antenna
3. Rear bumper mount whip antenna
4. Coaxial base station antenna
5. Ground-plane station antenna

B. Dimensions and Weight

Width 9-1/2" Height 5" Depth 8-1/4" Weight 12-1/4 lb.

C. Radio Installation. Select a convenient operating location for the radiotelephone. It may be mounted with the yoke either on the top or on the bottom. See drawing at end of book for mounting bracket and over-all dimensions.

Note: When connecting the d-c power cord, the black lead connects to the grounded side of the battery system, regardless of polarity.

The set is designed so that insertion of the appropriate line cord plug into the receptacle on the rear apron automatically makes the circuit connections for either 12 volt d-c or 115 volt a-c operation. The mounting yoke permits the set to be mounted securely into the vehicle, yet quickly removed for base station use as desired. It is merely necessary to remove the thumb screw at the side of the cabinet and disconnect the d-c power-cord plug and antenna plug to remove the radiotelephone from the vehicle.

D. Antenna Installation. The unit must be installed with an adequate antenna. This is normally done by the dealer, but the owner may perform the installation if he wishes. Be sure to read Part 19, paragraph 19.25(c) of the FCC Rules, covering antenna installations for Class D. It must be emphasized that the better the antenna installation the more satisfactory will be the results obtained, and the greater the range of operation.

The antenna installation for use with your citizens band radio will depend upon the type of service. For base stations a coaxial

fed dipole antenna or grounded plane antenna is suggested. Antennas for automobile installations will normally be of the quarter-wave vertical type, either helical wound or of a whip type. A whip antenna will measure 96 to 102 inches. A helical wound loaded antenna will be substantially less. The dealer from whom you purchase your equipment will be glad to make recommendations.

A type SO-239 antenna receptacle is provided for connecting to the antenna lead-in cable. This mates with a type PL-259 plug. If the antenna uses some other type of connector, an adaptor may be used or a PL-259 plug installed on the cable in place of the existing plug.

Mounting instructions for the various antennas will accompany the units.

V. TECHNICAL DATA AND TUNE-UP PROCEDURE

A. Circuit Description. The Radiotelephone receiver consists of a 12AU6 r-f stage, a 6U8 oscillator/mixer, a 12BA6 i-f stage, a 6BJ7 second detector, automatic noise limiter, squelch gate, a 12CR6 first audio amplifier, and a 12AQ5 audio power amplifier.

The 6CX8 performs all of the functions required in the r-f portion of the transmitter. The triode section operates as a crystal oscillator-doubler while the tetrode section is a Class C power amplifier. The 12CR6 and 12AQ5 serve as a modulator when transmitting. The power supply incorporates a 12X4 rectifier.

Switching from receive to transmit is accomplished by a single-pole, double-throw switch located in the microphone. On receive this switch connects the speaker to the power audio amplifier and places the transmitter-tube cathodes at a +120 volt potential thus disabling this portion of the set. When the microphone button is pressed the speaker is disconnected and the +120 volt line is grounded thus activating the transmitter r-f section and disabling the receiver crystal oscillator. A small portion of the transmitter output is rectified by the 12AU6 control grid and a high negative voltage is produced which cuts off this stage and the 12BA6 i-f stage. A resistor in the cathode of the tetrode section of the

6CX8 furnishes operating voltage for the microphone. Audio output from the microphone is impressed on the grid of the 12CR6 which operates as a speech amplifier.

B. Receiver Tune-up. The unit as shipped from the factory should not require any adjustment. If it becomes necessary to realign the receiver, it can be done either by using the signal from a crystal controlled transmitter of the correct frequency and with a VTVM connected to the AVC line, peaking all circuits for maximum AVC voltage or by accurately aligning the i-f amplifier to 455 Kc with the signal injected into pin #2 of the 6U8, preferably using a frequency meter to check the signal generator frequency, and then aligning the r-f and mixer stages, again using the signal generator.

C. Transmitter Tune-Up. (Note: It is unlawful for anyone except properly licensed technicians to make internal adjustments to the transmitter.)

The transmitter as shipped from the factory has been adjusted to match an antenna load of from 35 to 52 ohms.

Should readjustment be necessary in the field, the P. A. LOAD control on the rear apron should be set very near maximum clockwise and the P. A. TUNE Control adjusted for maximum brilliance of the TALK INDICATOR. Then turn the P. A. LOAD a little counter-clockwise and repeak the P. A. TUNE. Continue this process until maximum lamp brightness is obtained. The transmitter is designed to limit the power input to 5 watts when this tuning procedure is followed. If this tuning procedure is followed on a channel near the center of the band (such as at 27.085 mc which is supplied with the set) no retuning will be required for any other channel throughout the citizens band. If output appears to be low, peak the doubler coil at a channel near the band center. This coil is located on the chassis slightly forward of the 6CX8 tube.

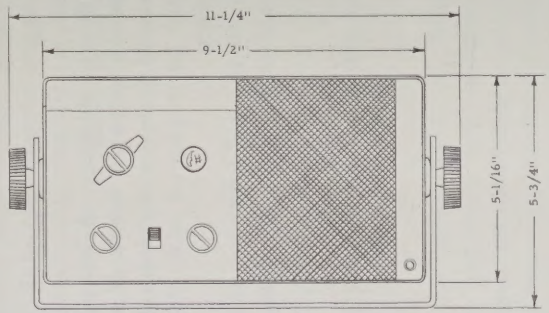
VI. MAINTENANCE

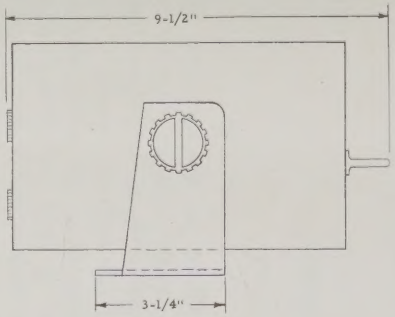
Caution: Maintenance procedures described in this section which apply to the transmitter must be performed by a technician holding a valid FCC radiotelephone license, first or second class.

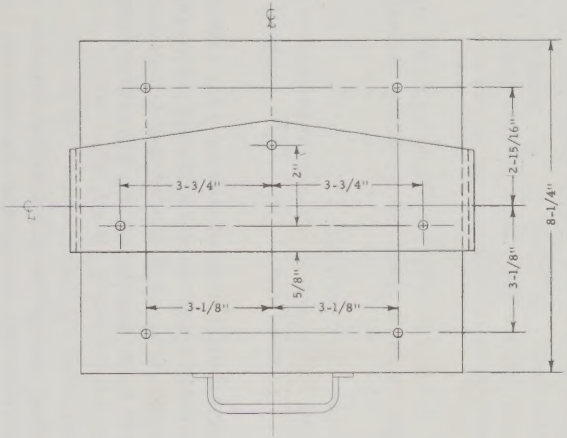
A. Receiver. Gradual decrease in receiver sensitivity is usually due to weak tubes. Replace as necessary. If tube replacement does not restore the receiver to normal performance, check the alignment. Also check crystal activity by replacing with a crystal of known activity.

B. Transmitter. Gradual decrease in transmitter performance is usually indicative of tube or crystal deterioration; check both and replace as necessary.

C. Power Supply. A heavy-duty vibrator is provided with the set which will give years of service. A faulty vibrator is usually indicated by fuses blowing repeatedly. If this occurs, the vibrator should be replaced with the exact type shown on the schematic diagram.

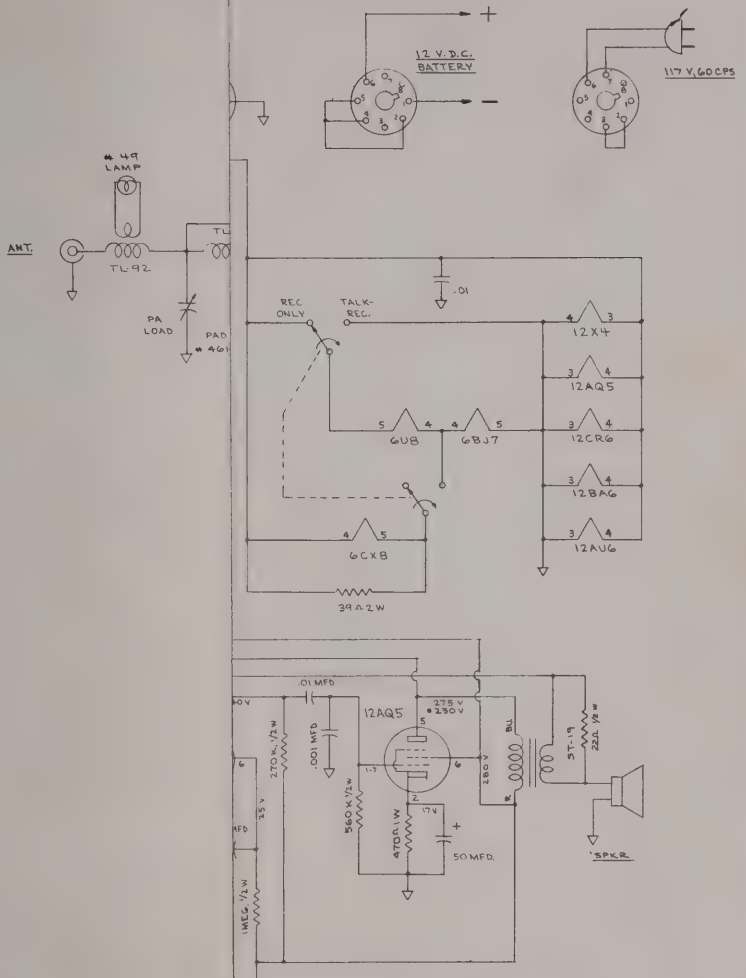






OUTLINE AND MOUNTING DIMENSIONS

MODEL TWR-1



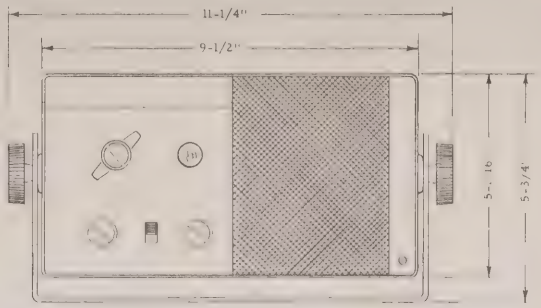
NOTES

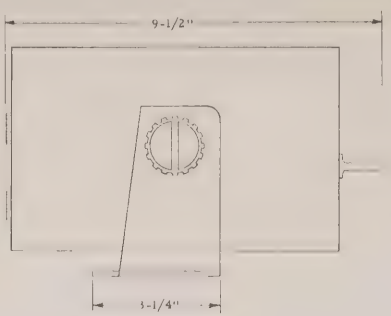
* INDICATES VOLTAGE WHILE TRANSMITTING. (MEASURED WITH 20,000Ω PER VOLT METER)

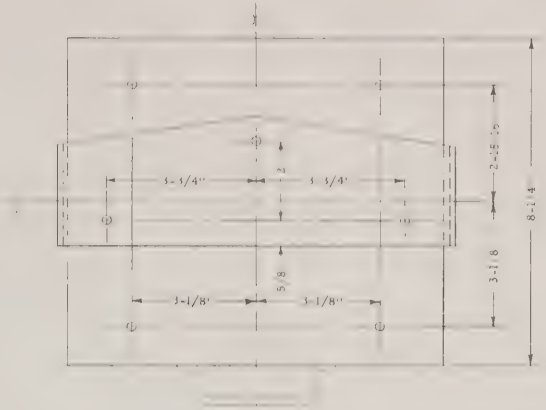
(A) --- SOME UNITS HAVE ST-102 TRANSFORMER AND 27 K. 2W RESISTOR (6CX8 SCREEN, PIN 8)

NOTES:
* INDICATES VOLTAGE WHILE

12 VOLT, D.C. & 117 VOLT, 60 C.P.S.







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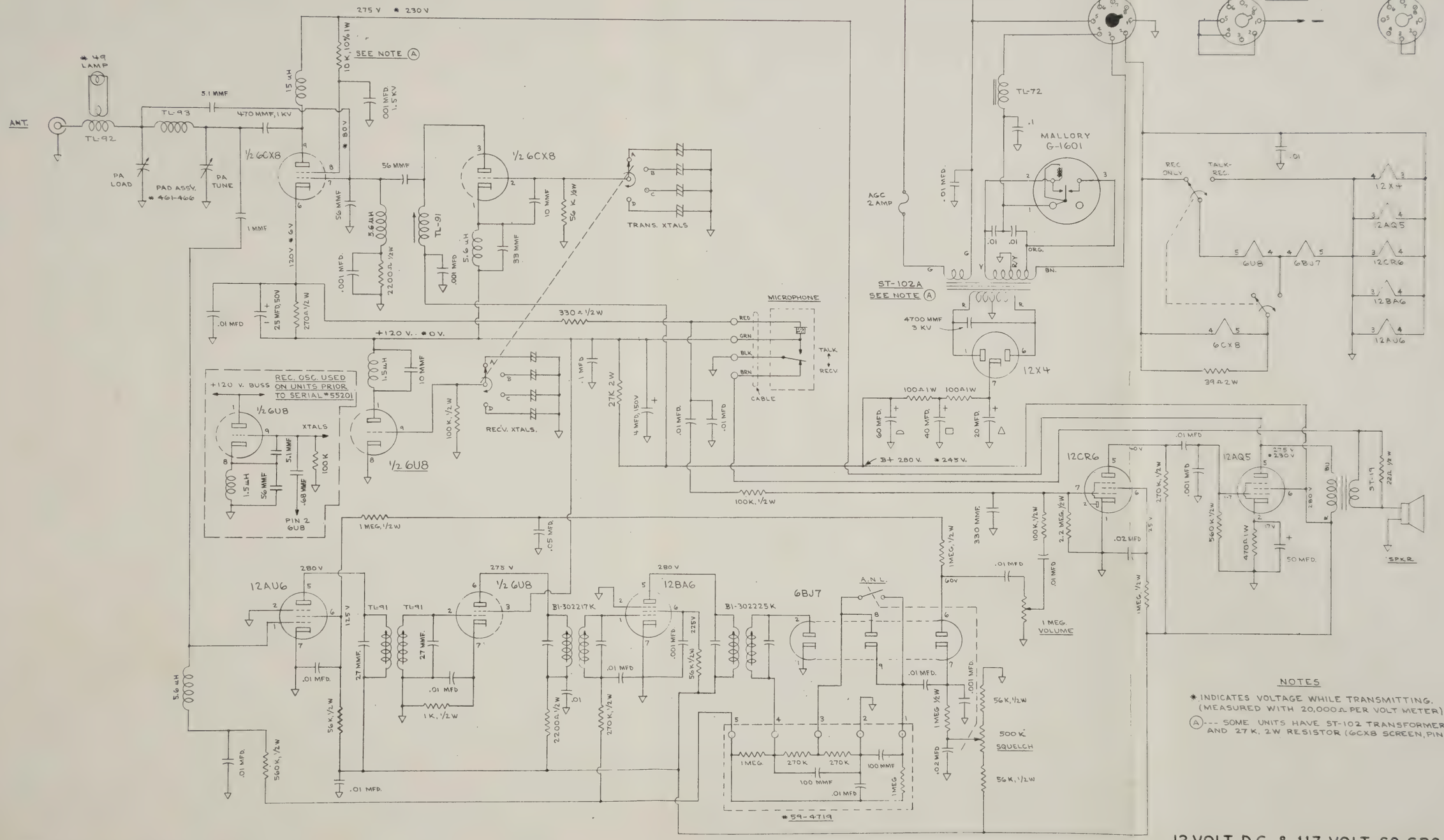

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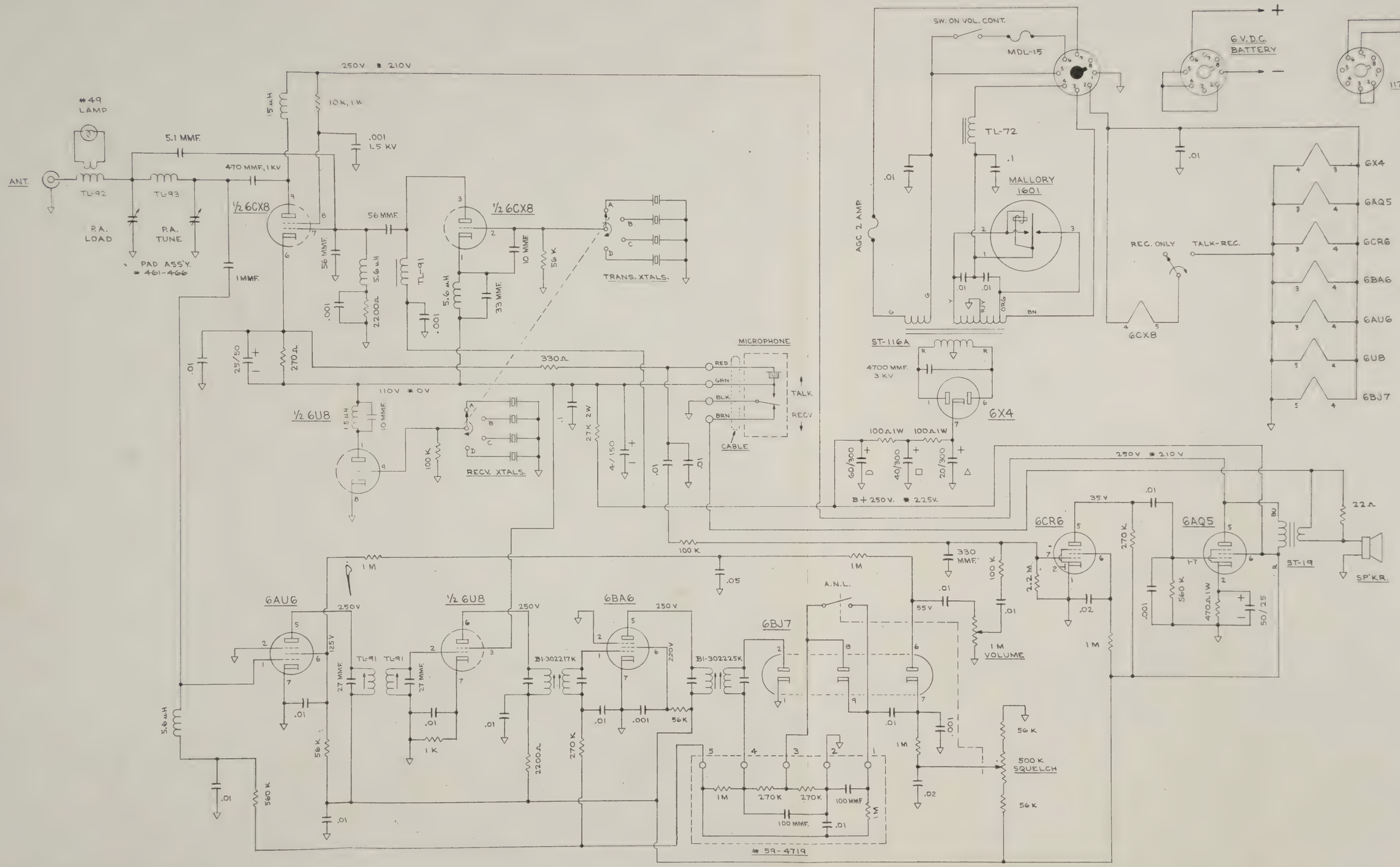


NOTE: UNLESS OTHERWISE INDICATED —
RESISTORS ARE 1/2 WATT, 10%
CAPACITORS ARE IN MFD'S.
* INDICATES VOLTAGE WHILE TRANSMITTING.

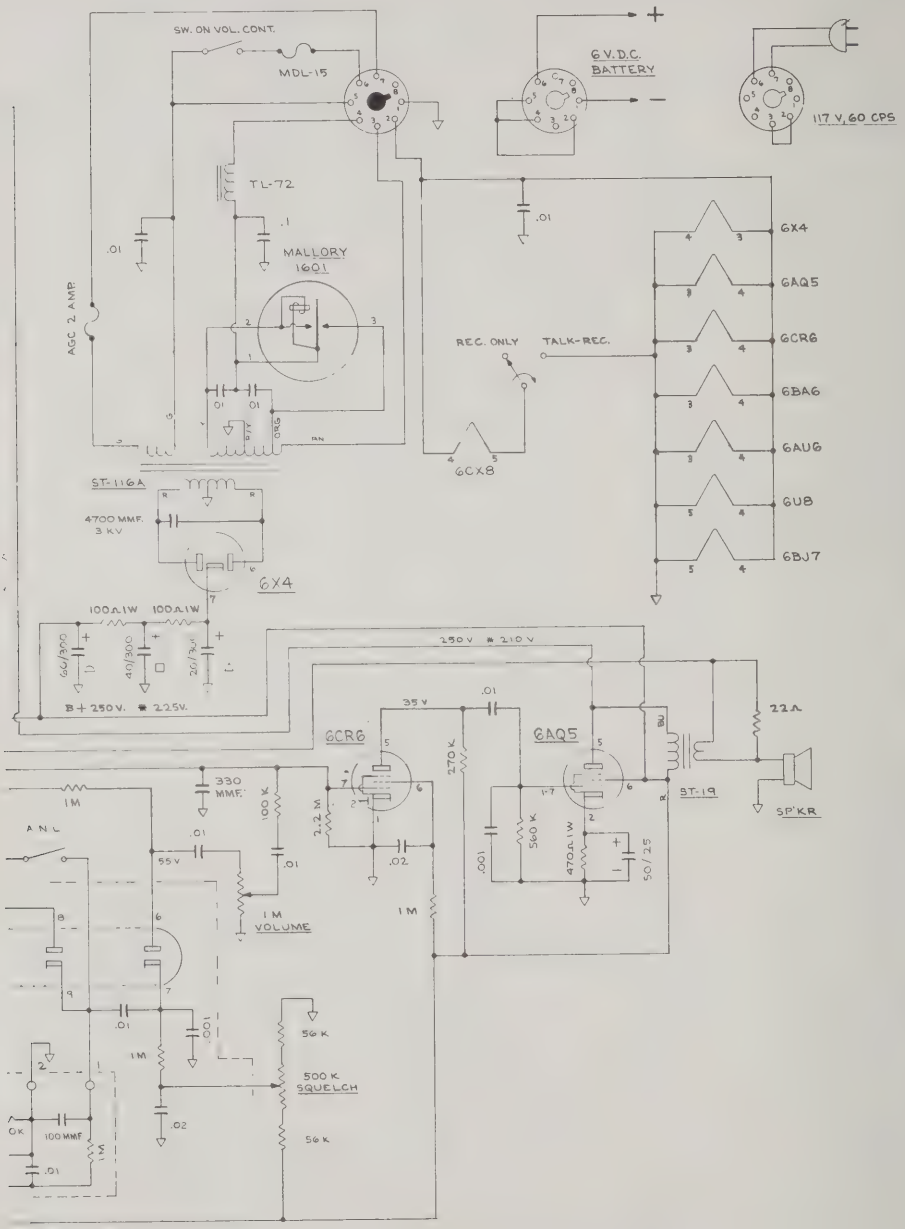
RAYTHEON COMPANY
"RAY-TEL" CITIZENS RADIOPHONE
MODEL TWR-1

6 VOLT, D.C. & 117 VOLT, 60 C.P.S.

6-24-60

VII. REPLACEMENT PARTS LIST

Part No.	Description	Source
TL-34	I.F. Transformer	Automatic
TL-35	I.F. Transformer	Automatic
TL-68	1.5 mH Choke	Wilco
TL-69	15 mH Choke	Wilco
TL-70	5.6 mH Choke	Wilco
TL-72	Hash Choke	Ratel
TL-91	Coil	Ratel
TL-92	Antenna Coil. Ind.	Apelco
TL-93	Tank Coil	Ratel
EB-1011	100Ω, 1/2 watt Resistor	Allen-Bradley
EB-1041	100KΩ, 1/2 watt Resistor	Allen-Bradley
EB-1051	1 Meg. 1/2 watt Resistor	Allen-Bradley
EB-2221	2200Ω, 1/2 watt Resistor	Allen-Bradley
EB-2251	2.2 Meg, 1/2 watt Resistor	Allen-Bradley
EB-2711	270Ω, 1/2 watt Resistor	Allen-Bradley
EB-2741	270KΩ, 1/2 watt Resistor	Allen-Bradley
EB-3311	330Ω, 1/2 watt Resistor	Allen-Bradley
EB-5631	56KΩ, 1/2 watt Resistor	Allen-Bradley
EB-5641	560KΩ, 1/2 watt Resistor	Allen-Bradley
GB-1011	100Ω, 1 watt Resistor	Allen-Bradley
GB-1031	10KΩ, 1 watt Resistor	Allen-Bradley
GB-1041	100KΩ, 1 watt Resistor	Allen-Bradley
GB-3321	3300Ω, 1 watt Resistor	Allen-Bradley
GB-4711	470Ω, 1 watt Resistor	Allen-Bradley
HB-3901	39Ω, 2 watt Resistor	Allen-Bradley
GA	1 mmfd ceramic cap. tubular	Stackpole
GA	.68 mmfd ceramic cap. tubular	Stackpole
GA	5 mmfd ceramic cap. tubular	Stackpole
GP1K	10 mmfd ceramic cap. tubular	Stackpole
GP1K	33 mmfd ceramic Tubular	Erie
GP1K	56 mmfd Ceramic Cap. Tubular	Erie
NPO Style 801	27 mmfd ± 5% Ceramic disc Cap.	Erie
HD15-1000	.001 mfd 1.5 k V disc cap.	Erie
12V102KA5	.001 mfd 500V disc cap.	Electra
12X103MA5	.01 mfd 50V disc cap.	Electra
20N202ZA6	.02 mfd 600V disc cap.	Electra
20N103ZA6	.01 mfd 600 V disc cap.	Electra
24N472MA30	4700 mmfd 3KV disc cap.	Electra
VCM20B471M	470 mmfd 1KV 1/2 P.S Mica	Electromotive
PM2S5	.05 mfd 200V tubular paper	C-D
PJ2P1	.1 mfd 200V tubular paper	C-D



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"RAY-TEL" CITIZENS RADIOPHONE
MODEL TWR-1

6 VOLT, D.C. & 117 VOLT, 60 C.P.S.

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GA	5 mmfd ceramic cap. tubular	Stackpole
GP1K	10 mmfd ceramic cap. tubular	Stackpole
GP1K	33 mmfd ceramic Tubular	Erie
GP1K	56 mmfd Ceramic Cap. Tubular	Erie
NPO Style 801	27 mmfd ± 5% Ceramic disc Cap.	Erie
HD15-1000	.001 mfd 1.5 k V disc cap.	Erie
12V102KA5	.001 mfd 500V disc cap.	Electra
12X103MA5	.01 mfd 50V disc cap.	Electra
20N202ZA6	.02 mfd 600V disc cap.	Electra
20N103ZA6	.01 mfd 600 V disc cap.	Electra
24N472MA30	4700 mmfd 3KV disc cap.	Electra
VCM20B471M	470 mmfd 1KV 1/2 P.S Mica	Electromotive
PM2S5	.05 mfd 200V tubular paper	C-D
PJ2P1	.1 mfd 200V tubular paper	C-D

Replacement Parts
(Continued)

Part No.	Description	Source
BBR4-150	4 mfd 150V tubular elec. paper tub.	C-D
BR-255	25 mfd 50V tubular elec. paper tub.	C-D
DO-380	60-40-20/300V 50/25V FP	C-D
59-4719	Couplate	Centralab
G-1601	Vibrator	Mallory
1601	Vibrator	Mallory
AGC	7.5 Amp. Fuse	Bussmann
AGC2	2 Amp. Fuse	Bussmann
ST-19	Output Transformer	Quality
ST-102	Power Transformer	Quality
ST-116	Power Transformer	Quality
G-45	1 Meg. Vol. Control w/SPST switch, Audio Taper	CTS
VF-45	500KΩ Squelch Control w/DPST switch, Linear Taper	CTS
P4VA-NW	4" Speaker	Jensen
#49	Lamp	Tung-Sol
20B	Lamp Assembly (no jewel)socket, sleeve, nut, washer	Drake
105P-T3270	Small round grey knob, push on	Griffith
101TB270	Bar Knob	Griffith
147-10	Clear lucite lens	Johnson
F-49	2-pole 4-pos. wafer assy.	Apelco
12AU6	Tube	Raytheon
6U8 or 6U8A	Tube	Raytheon
6CX8	Tube	Raytheon
6BJ7	Tube	Raytheon
12AQ5	Tube	Raytheon
12BA6	Tube	Raytheon
12CR6	Tube	Raytheon
12X4	Tube	Raytheon
461-466	2 section trimmer, special, w/1 #461, 1 #466 tank and output condenser	Apelco
SW-726	DPDT Slide Switch	Wirt
GW-4	Crystal, Receiver	Wright
GW-4	Crystal, transmitter	Wright